

Zero Defects & Construction

Why the Construction industry has a place in Industry 4.0

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Some questions for you

- Have you ever thought that Construction and Manufacturing industries are not that different?
- Do you think that Construction is way too rough for sophisticated IT solutions?
- Do you believe that defects occurrence in Construction is so common that zero-defects is a utopia?

A construction site “is” a manufacturing plant

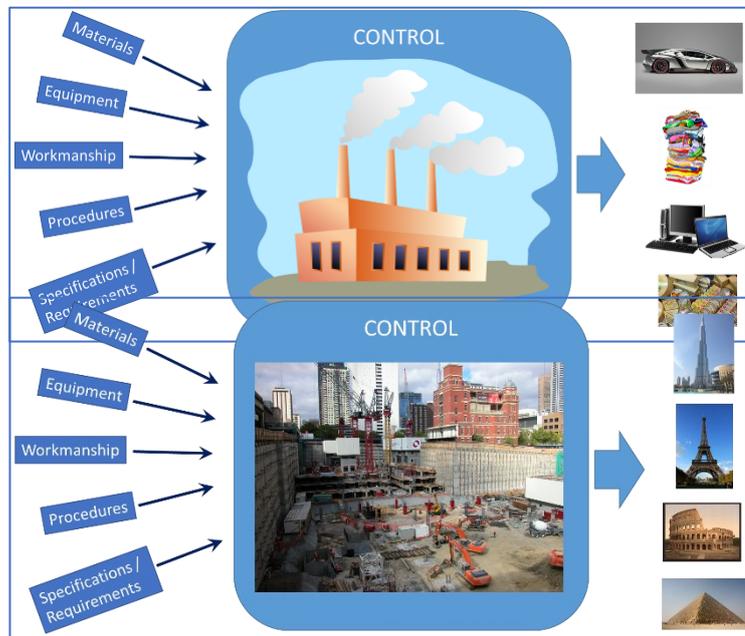
Traditional manufacturing industry is usually what comes to mind when thinking of the application of IT research and developments in the scope of Industry 4.0. Concepts such as smart digital technology, machine learning and big data are seldomly related (and, many times, found to be unrelatable at all) to Construction or a construction site.

However, the similarities between a construction site and a manufacturing plant are many:

- Both require similar types of inputs
- Both are subject to extensive material, process and product controls
- Both generate a large amount of data and records
- Both involve complex supply chains

Differences between both sectors relate to:

- Specifications/requirements that can be as strict, or stricter, in the case of construction, than in traditional manufacturing and are subject to rigorous national and international standards, as construction products are most often to be used by thousands of people
- The number of stakeholders involved. In construction this often actively involves public authorities, many suppliers and subcontractors, institutions and the public



Of course, the most obvious difference relates to the products themselves: construction products have a warranty and durability that normally exceeds that of manufacturing products and, usually, the factory becomes the product!

Construction's alternative approach to defects

The increased construction product warranty does not mean that this is the typical zero-defects industry – unfortunately! In fact, although it can be accepted that Construction industry falls within the scope of Industry 4.0 it may be more difficult to perceive how can zero defects be achievable in Construction.

The blunt truth is: It can't. Defects in construction will happen, as it is a very labour-intensive industry. Despite all the controls in place, more-or-less strict depending on what is being built, workmanship remains a source of defects difficult to eliminate. Additionally, the number of operations being carried out, materials being used, equipment operating, all at the same time, is in many cases so large that controls needs to be implemented through sampling rather than on a 100% basis (except for critical structures or operations).

Usually, a defect in construction affects the built structure's safety, purpose, operation and/or aesthetics (if the defect is visible, in this case). Even so, exceptions to this rule are not uncommon in History...

Also, correcting a defect can be even more costly in construction than in traditional manufacturing, eventually involving the demolition of structure parts that took days to build, with significant losses of time, resources and money. In the end, a balance needs to be made between cost of repair and risk/cost of not repairing.



Defects in construction can, however, be approached from a different perspective. Knowing that defects will occur for reasons that fall out of the usual tight control (workmanship), it is still possible:

- To reduce the chance of a defect or error occurring
- To improve processes and efficiency, releasing resources for more active control tasks

Collaboration within the supply chain

During construction, both Works Contractor (the builder) and the Works Supervisor (monitors the builder's performance and ensures quality control) are involved in many activities that require a strict planning. Some of these require also their physical presence. This may be a source of problems, namely:

- Delays when activities occur simultaneously ⇒ Waste of time and resources ⇒ Inefficiency. This could be avoided if some of the activities could be performed without the presence of one or both actors, for example if the characteristics of a material to be delivered were known even before it left the production plant
- There may be delays related to the delivery of a critical material, leading to the need to reschedule the project, which not only may affect project deadlines, but is a time-consuming activity ⇒ Waste of time and resources ⇒ Inefficiency

During the use of infrastructure, it is likely that problems or defects appear sooner or later, mostly due to the materials usual wear and tear and despite regular maintenance operations. However, it may happen that unexpected material related defects occur, which need to be investigated mostly to allocate responsibility for the damage costs.

Defect investigation during operation faces several problems, namely:

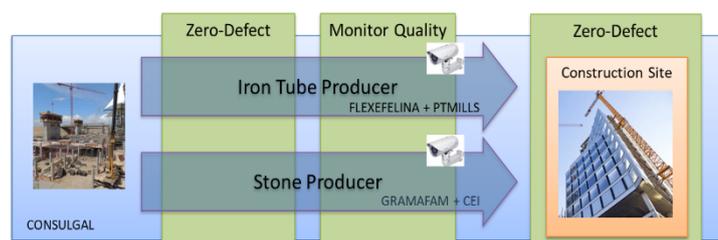
- Large and difficult to check construction archives, difficulty to identify the material lot used at a certain location ⇒ Waste of time and resources ⇒ Inefficiency
- Lack of collaborative investigation results analysis, which could lead to improvements to material specifications or production process and avoid future similar defects ⇒ Chance of a similar defect persists

Most of these situations could be corrected or improved through a better collaboration throughout the supply chain.

What will ZDMP achieve

ZDMP will contribute to solve these through IT solutions (zApps) that will allow:

- The actors in the construction site to access information about production and quality of materials, even before they are shipped to the site. This will give the Works Contractor and Works Supervisor the chance to decide if they should be present when the material arrives at the work site and will facilitate material verification and quality control
- Delays, both incidental or notified, to be automatically accounted for to generate a modified project schedule, with a simplified verification and validation procedure
- Easy identification of the specific material responsible for a defect at a specific location in the infrastructure and quicker access to the corresponding quality records
- More efficient and effectively collaborative defect causes assessment contributing to improved material suppliers' control over their processes and products, thus reducing the chances of defects in construction



ZDMP Links

• Architecture Component(s)	None – Pilot Domain
• Work Package	WP10 – Extended Sector Uses Cases: Construction & Electronics
• Tasks	All tasks

References

None